Measuring sustainability performance in agri-food companies

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Abstract

Sustainability is becoming an integral part of the value proposition of companies in the agri-food sector. Quantifying sustainability performance is an important aspect of any sustainability initiative; and enterprise software systems play an important role in quantifying sustainability. However, measuring sustainability is not a straightforward process as the data required are not always available or not available in a suitable form. In this paper we show the challenges and opportunities in measuring sustainability by identifying what data are available and how they are captured in a transport management system for a list of sustainability indicators in pilot study involving two agri-food companies.

Keywords

Sustainability, Agri-food companies, Sustainability performance indicators, IT, Enterprise systems

1 Introduction

Agri-food companies increasingly consider sustainability as an unavoidable part of their value proposition for good reasons. Investors (particularly institutional investors) are facing strong calls to invest in socially responsible companies [1]. Governments are pressured to set minimum sustainability standards, such as targets for emissions reductions. Research claims that consumers' buying behaviour is also changing in favour of sustainable products [2-4], though this may not largely be the case during tough economic conditions or in poor regions.

Sustainability is about the broader impacts of doing business; it includes many aspects that are usually grouped into financial (profit), environmental (planet) and societal (people) impacts. Though sustainability is gaining widespread attention businesses will have difficulty justifying new sustainability initiatives unless they identify their sustainability objectives and targets, measure their current performance and clearly show that there is a gap that needs to be bridged.

Currently there are two ways of defining sustainability performance: the first is product-based and the second is corporate (or organisation) based. Product-based sustainability performance indicators include product ecological footprints, such as carbon [5] and water footprints [6]. Though not recognized as such price is also a product-based sustainability indicator, albeit a financial one. The focus on products is probably because products are considered to embody, as it were, all of the impacts that occurred from the beginning [7]. Therefore, product-based indicators represent the impact of the entire the supply chain. Corporate sustainability performance indicators are, on the other hand, measured using the organisation as an entity. Sustainability standards and guidelines, such as the GRI (Global Reporting Initiative) [8], focus mainly on corporate sustainability impacts.

Currently, only few agri-food companies are capable of measuring their sustainability performance. For instance, of the 48 food and beverages companies listed in the 2012 transparency benchmark index of the Dutch Ministry of Economic Affairs only a third scored half (100 and above on the scale of 0 to 200); nearly half of the 48 companies scored 0 [9]. The low score do not necessary mean that the companies are not sustainable; but it shows that many agri-food companies are not able to prove their sustainability claims.

Quantifying sustainability performance is important but not easy. It requires identifying suitable sustainability indicators, identifying data that enables computing the indicators, capturing the data using enterprise information systems and evaluating the indicators.

In this paper we aim to show the challenges agri-food companies face and the opportunities they have in quantifying their sustainability performance. We do that with the help of an illustrative pilot study where a sustainability initiative is being implemented.

The paper is organized as follows. Section 2 describes the methodology we followed. Section 3 presents the framework we used to analyse the role of enterprise systems. In section 4 we present provisional results from the ongoing pilot study. Finally, in section 5, we discuss the results and make concluding remarks.

2 Methods

The pilot under study is being conducted following a sustainability improvement framework called the SCALE journey currently being developed in the context of the SCALE[1] research project.

The SCALE project is broad; it combines action research with theoretical research. As an action research [10] interventions are being undertaken, following the SCALE journey, in two pilot companies changing the way the companies do their businesses. The interventions are mainly being executed by a logistic service provider who is part of SCALE project – henceforth will simply referred to as *the solution provider*. The solution provider identifies business and IT requirements, maps out the current business processes, designs new business processes that will bring about sustainability improvements, deploys appropriate enterprise systems that support the new business processes, and finally monitor the chosen sustainability performance indicators. As a theoretical research new collaboration and optimization models, frameworks and tools are being developed. The aim of the project is to present a comprehensive sustainability improvement framework that is tested and validated in a number of pilot studies.

The pilot study involved two food companies in the UK who primarily aim to address inefficiency in order delivery through logistic collaboration but are willing to participate in the pilot study and explore in depth the benefits of sustainability. The first company manufactures malt and malt related products and ingredients, has annual turnover of around €60 million and has already undertaken some sustainability initiatives – such as local

[1] www.projectscale.eu

sourcing. The second company is roughly the same size as the first and processes grain and cereals for use in food manufacturing and wishes to implement sustainable practices. The companies operate in two different supply chains but aim at consolidating their transportation activities by redesigning their business processes and deploying a transport management system offered by the solution provider.

This paper uses the pilot study to show which opportunities and challenges agri-food companies face in quantifying sustainability performance indicators. The results presented are based on a single pilot study that is in progress and thus preliminary. A more complete picture will only unfold when all pilot studies are concluded.

3 Framework

In order to identify the challenges and opportunities in measuring sustainability performance we consider both the process steps (*i.e.* the SCALE journey) and the content (*i.e.* the indicators and data) of measuring sustainability performance.

3.1 The SCALE journey

The SCALE journey consists of five phases, namely: *exploration*, *opportunity*, *solution design*, *implementation* and *monitor & evolve* (Figure 1).

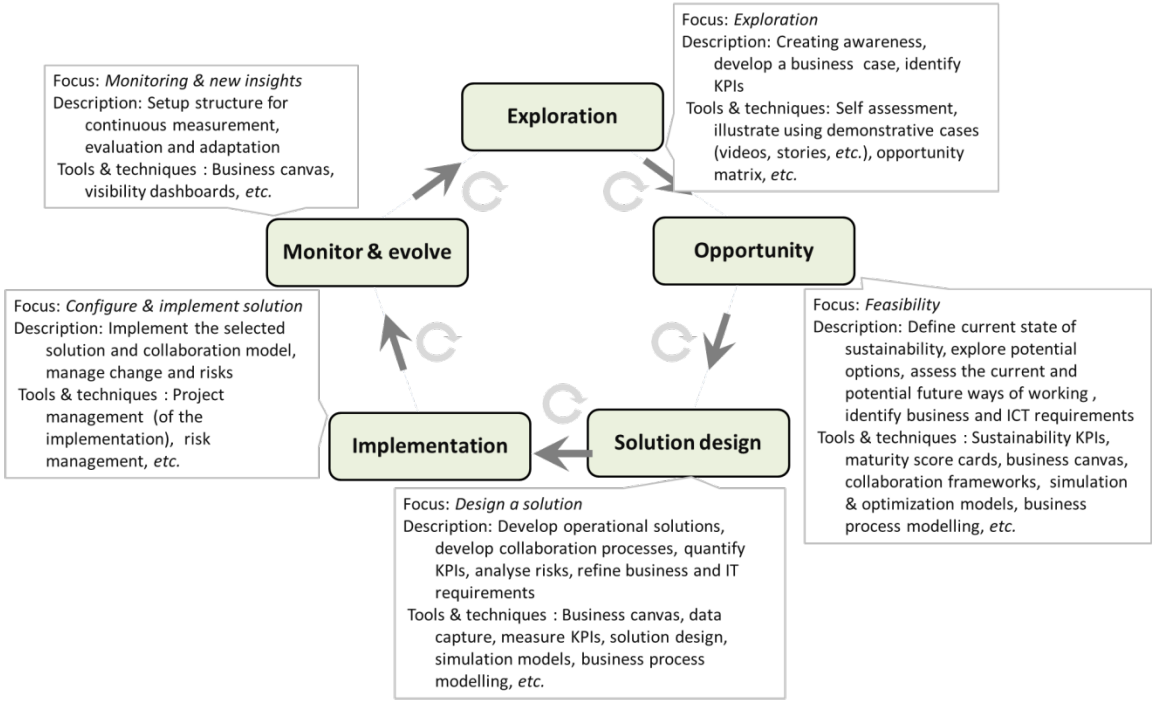

Figure 1. The SCALE journey – a sustainability improvement process.

The SCALE journey is a problem solving process. Generally, solving problems in organisations through research is considered as action research and follows a cyclic process that involves diagnosis, planning action, acting, learning and from learning back to diagnosis [10]. The SCALE journey also involves re-designing of existing business processes. Such a

research is often referred to as design-oriented research since it produces new design artefacts and methods – as opposed to studying existing ones (behavioural study) [11].

The SCALE journey is about how to improve sustainability in the agri-food sector, mainly agri-food logistics. It proposes a cyclic process consisting of five phases that guide how sustainability initiatives can be implemented. The first phase is *exploration*. In this phase a business case for creating new sources of value from sustainability consideration gets formulated and appropriate sustainability performance indicators are identified. The second phase is *opportunity* where the current state of sustainability and potential improvement options are explored. By identifying the current (AS-IS) business processes and defining the future (TO-BE) business processes business and IT requirements are identified. The third phase is *solution design* where operational solutions, including a set of suitable enterprise systems, are selected and designed. The fourth phase is *implementation* where the solution is configured, deployed and put into use. In the last phase, *monitoring*, the selected performance indicators will be monitored. This last phase will generally lead to new insights that will call for a new cycle of improvement process.

3.2 Sustainability KPIs

In the SCALE project a number of sustainability Key Performance Indicators (KPIs) are identified. These indicators are traditionally not quantified and monitored by the pilot companies. It turns out that quantifying the indicators is not straightforward. As a result the quantification of the indicators became an important research agenda and is the focus of this paper. To understand why quantifying indicators is not a straightforward task we have to look at the enterprise systems from which the necessary data comes and what kind of enterprise systems are available.

3.2.1 Supply chain management

The kind of enterprise systems available depends on the needs of companies. Today's companies consider themselves to be part of one or more supply chains. To optimize their performance they collaborate with other companies within, and sometimes outside, their supply chains. This led to a new management practice – the supply chain management practice – and the corresponding supply chain enterprise systems.

Broadly speaking supply chain management is considered to be "the integration of key business processes from end user through original suppliers ..."[2] In practice, managing the entire supply chain end-to-end – from raw materials to end use – will be a difficult task [12]. Instead many view the concept of supply chain from a perspective of a specific organisation. According to SCC (Supply Chain Council) the management of supply chains consists of the management of own processes and coordinating with the processes of suppliers and customers (Figure 2) [13].

[2] Global Supply Chain Forum

Figure 2. SCOR (Supply Chain Operations Reference-model) processes [13].

3.2.2 Enterprise systems

In the past ERP (Enterprise Resource Planning) systems provided an all-inclusive systems by overcoming the fragmentation of software and data within an organisation. Even if ERP systems are widely used they are no more considered sufficient. Today's enterprise systems product catalogues consist of more systems, mainly matching the processes of the SCOR reference model. While the SCOR model identifies *plan*, *source* (procurement), *make* (production) and *deliver* (supply) business processes, the IT industry provides the corresponding systems: APS (Advanced planning and scheduling) for planning and scheduling, OMS (Order Management Systems) for management procurement operations, ERP for managing production activities, WMS (Warehouse Management Systems) to manage inventories, and TMS (Transport Management Systems) for managing of deliveries (Figure 3).

Figure 3. Information systems corresponding the SCOR reference model.

Since businesses are of diverse sizes and types, there are diverse enterprise systems. Generally, each one is a complex system comprising of layers of subsystems called modules (or applications) and features (or options). For instance, the 2013 Oracle product list [14] consists of what it calls a logistics (TMS + WMS) system consisting of five modules (Inventory, Transpiration, Pedigree, Landed cost, Global trade and Pedgree & Serialization management application) which in turn consist of a number of features (options).

3.2.3 Quantifying sustainability KPIs

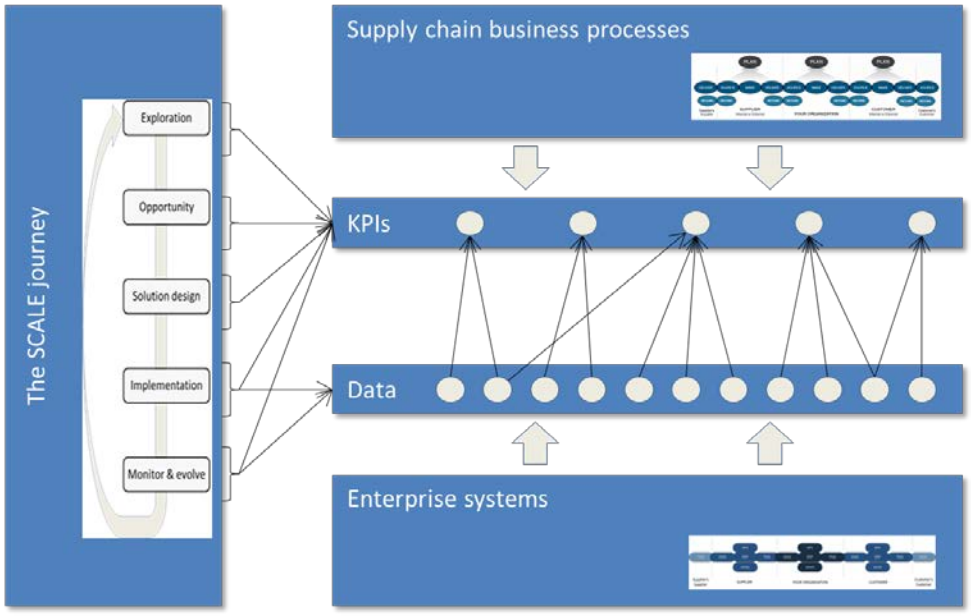

Figure 4. The relation among the SCALE journey, the business process re-design and the enterprise systems in quantifying sustainability KPIs.

Putting the above together the challenges and opportunities in quantifying sustainability can considered to relate to three interrelated aspects: the re-design of business processes for which sustainability performance indicators has to identified, the improvement processes in which the indicators are quantified and the enterprise systems from which the data comes (Figure 4). In the pilot study below we use this framework in describing the challenges and opportunities.

4 The pilot study

4.1 Sustainability KPIs and data

To identify relevant sustainability KPIs for the pilot study literature and survey studies were conducted in the Netherlands. The survey involved two sets of companies: food companies and logistic service providers. The survey results showed that both sets of companies identified *CO_2 emission*, *trained employee*, *absenteeism* as relevant sustainability indicators. In addition, food companies identified *water use*, *energy use*, *male-female ratio*, *total waste*, *accidents*, *renewable energy*, *recycling & recovery rate* as relevant to them; logistic service providers identified *fuel use* as relevant indicator and differentiated between *CO_2 emission* caused by transport and facilities[15]. Combining these results with the results of literature study the indicators shown in Table 1 were selected for the pilot study.

Table 1 also shows the raw data that the solution provider believes that it will be able to capture with the help of the enterprise systems that it has in its product catalogue.

Table 1. Sustainability indicators and the data available in enterprise systems that can be used to compute the indicators.

Indicator		*Data required*
Profit	Energy cost	Fuel consumption, fuel price
	Transportation cost	SKU[3] order lines, transpiration cost per leg
	Operations cost	Transportation cost components
	Production cost	Food processing cost components
Planet	Emissions	Fuel consumption, CO_2 emission factor per fuel type
	Energy use	Fuel consumption, energy density per fuel type
	Food miles	Order miles per leg, SKU order lines
	Material consumption	Quantity of items, weight per type of item
	Waste	Units lost, disposable packages
People	Employment	New employees, turnover
	Noise	Order miles per leg, SKU order lines
	Accidents	Order miles per leg, SKU order lines

The next step was identifying where the data comes from. Table 2 shows the enterprise systems and the specific modules of those systems where the data in Table 1 will come from. Since the pilot study focuses on delivery logistics the main enterprise system involved is TMS.

Table 2. Data required to measure sustainability indicators and features of the enterprise systems that can serve as data sources.

Nr.	*Data required*	*Data source (system and module)*
1	Fuel consumption	TMS, Execution
2	Fuel price	TMS, Finance
3	SKU order lines	TMS, Planning
4	Lost units	TMS, Execution
5	Disposable packages	TMS, Planning
6	Transpiration cost per leg	TMS, Finance
7	Transportation cost components	TMS, Finance
8	Food processing cost components	ERP, Production planning
9	Quantity of items	ERP, Production planning
10	Miles per leg or order	TMS, Planning
11	Weight per item	Database
12	CO_2 emission factor per fuel type	Database
13	Energy density per fuel type	Database

[3] SKU = Stock Keeping Unit

14	Weight per type of item	Database

4.2 Mapping KPIs to data

Enterprise systems are generally complex and expensive and as a result companies are provided with options to select only the modules and features they need as, for instance, the Oracles software product price list [14] shows. Table 3 shows which data are available from a TMS system (only the *planning* and *execution* modules are included) and how they relate to the selected KPIs. This table in combination with Table 1 and Table 2 shows that there is a considerable overlap of data required to compute *profit* and *planet* aspects and many of *planet* related sustainability indicators can be computed from data that is normally used for computing *profit* related indicators. Since most of the features will be implemented in the pilot companies, the data that will be made available will enable to track sustainability aspects that may be considered relevant in future improvement iterations.

Table 3. Data availability from a TMS system. abbreviations: *EDI=Electronic Data Interchange, GPS=Global Positioning System, RAG=Red-Amber-Green, UOM=Unit of Measure*.

Modules	*Features*	*Data*	*Used in KPIs*
TMS Planning	Core planning	Manual load building / load amendments	3, 5
		Stackability & constraints (tainting *etc*.)	
		Manual route schedules	
		Resource (driver & tractor) allocations	
		Warehouse capacity	
		Multi-modality	
		Calculated time & distance	10
		Allocated carriers	
		Split orders	
		Volumetrics	
		Booked delivery points	
	Optimization	Automatic load buildings	
		Automatic carrier allocations	
		Automatic route schedules	
		Live re-plannings	
	Visibility	Visibility of loads & orders	
		Status updates & locks	
TMS Execution	Core execution	Manual route adjustments	
		Resource (trailer) availabilities	
		Multi modalities	
		Visibility of order cross-dockings	

		Manual resource (trailer) allocations	
	Visibility	Visibility of routes, loads & orders	
		Trips/routes & order debriefs	1,4
		Real-time GPS feeds of late RAGs	
		Route actions recorded	
		Status updates & locks	
		Failure recordings	

4.3 Relation to the SCALE process

The indicators are identified in the first phase of the SCALE journey which is *exploration*. Under normal circumstances the pilot companies will have to select the sustainability KPIs that are relevant for them and their supply chain. But in the pilot study the selection is made for them by the researchers. This shows that the companies are not yet fully aware of the new value that can be created through sustainability consideration but are nevertheless committed to sustainability and are willing to learn. During the opportunity phase it become clear that most of the indicators cannot be quantified with ease since the required data is not captured. In the solution design phase the current business processes were identified and the desired future business were designed. Based on the business and IT requirements CALIDUS TMS[4] is selected. The system is currently being deployed and the results will be monitored in the remaining phases.

5 Discussion and conclusion

In this paper we sought to find out what the challenges are in measuring sustainability and what opportunities current enterprise systems provide. The main challenge during the pilot study has been the fact that the current state of sustainability performance cannot be determined. That in turn becomes a risk factor because the improvement initiative may have to be abandoned at later stages – instead of on time and at an earlier stage – if the intervention will not lead to significant performance improvements. The solution provider noted that it has experienced such cases. The current state of sustainability performance could not be determined because most of the data required to compute the sustainability indicators listed in Table 2 are not available. This in turn is because the pilot companies use basic software systems and the data required is either not captured or not easily accessible.

The main opportunity is the availability of a wide range of data that will be made available when enterprise systems are implemented – even if the systems would be deployed with only *profit* consideration in mind. This is because data that are being captured for maximizing profit (*e.g. transportation/energy cost*) are also to a large degree the data needed to compute the environmental impacts (*e.g. emissions*/*energy use*).

[4] http://www.obs-logistics.com/transport-management.php

The results also show that measuring sustainability performance is not a straightforward task. For instance, data on fuel consumption is obtained from *trip/route & order debriefing* data – as there is no "fuel consumption" data to be read off directly in the particular TMS system. In addition, the required data may have to be obtained by aggregating a number of data sets. For instance, data on fuel consumption can be obtained by aggregating data for each leg of the journey, which may have to come from different data sources.

The rest of the improvement process for the pilot study is yet to take place. As this study is based on limited information and an ongoing pilot study no firm conclusions can be made. We are currently working on this study will in the future be able to provide a more detailed account of the how sustainability performance can be measured, what the challenges and opportunities are and how to deal with the challenges and opportunities.

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